

CLAIMS

1. A zoom lens comprising:

a first lens group having positive refracting power;
a second lens group having negative refracting power;
a third lens group having positive refracting power;

and

a fourth lens group having positive refracting power,
which are arranged from an object side in that order,

wherein during variation in lens position from a wide angle end state to a telescopic end state, the first and third lens groups are fixed at predetermined positions along the optical axis, the second lens group is moved toward an image side, and the fourth lens group moves so as to compensate fluctuations in image-surface position due to the shift of the second lens group,

wherein an aperture diaphragm is arranged adjacent to the object side of the third lens group or within the third lens group, and is fixed in the optical axial direction during the variation in lens position,

wherein the second lens group includes a negative meniscus lens with a concave surface opposing the image side and a cemented lens of a biconcave lens and a positive lens with a convex surface opposing the object side, which are arranged from the object side in that order, and the

negative meniscus lens is made of a compound lens of a glass lens and a resin lens formed adjacent to the image side of the glass lens, the lens surface adjacent to the image side of the resin lens being aspheric, and

wherein the following conditional equation (1) is satisfied:

$$(1) \ n_2 > 1.75,$$

where n_2 is the average refractive index of glass lenses constituting the second lens group with respect to d ray.

2. The lens according to Claim 1, wherein the following conditional equation (2) is satisfied:

$$(2) \ 0.25 < R_s/D_a < 0.45,$$

where R_s is the radius of curvature of the lens surface nearest to the image side of the meniscus lens in the second lens group and D_a is the distance from the lens surface R_s in the wide angle end state to the aperture diaphragm.

3. The lens according to Claim 1, wherein the following conditional equation (3) is satisfied:

$$(3) \ 0.7 < (R_1 - R_2)/(R_1 + R_2) < 0.9,$$

where R_1 is the radius of curvature of the lens surface nearest to the object side of the negative meniscus lens arranged in the second lens group and R_2 is the radius of curvature of the lens surface adjacent to the image side of

glass lenses constituting the negative meniscus lens arranged in the second lens group.

4. The lens according to Claim 1, wherein the following conditional equation (4) is satisfied:

$$(4) \quad 0.3 < |f_2| / (f_w \cdot f_t)^{1/2} < 0.4,$$

where f_2 is the focal length of the second lens group; f_w is the focal length of the entire lens system in the wide angle end state; and f_t is the focal length of the entire lens system in the telescopic end state.

5. An image-pickup apparatus comprising:

a zoom lens; and

an image-pickup element for converting optical images formed by the zoom lens into electric signals,

wherein the zoom lens includes a first lens group having positive refracting power; a second lens group having negative refracting power; a third lens group having positive refracting power; and a fourth lens group having positive refracting power, which are arranged from an object side in that order,

wherein during variation in lens position from a wide angle end state to a telescopic end state, the first and third lens groups are fixed at predetermined positions along the optical axis, the second lens group is moved toward an

image side, and the fourth lens group moves so as to compensate fluctuations in image-surface position due to the shift of the second lens group,

wherein an aperture diaphragm is arranged adjacent to the object side of the third lens group or within the third lens group, and is fixed in the optical axial direction during the variation in lens position,

wherein the second lens group includes a negative meniscus lens with a concave surface opposing the image side and a cemented lens of a biconcave lens and a positive lens with a convex surface opposing the object side, which are arranged from the object side in that order, and the negative meniscus lens is made of a compound lens of a glass lens and a resin lens formed adjacent to the image side of the glass lens, the lens surface adjacent to the image side of the resin lens being aspheric, and

wherein the following conditional equation (1) is satisfied:

$$(1) \ n_2 > 1.75,$$

where n_2 is the average refractive index of glass lenses constituting the second lens group with respect to d ray.

6. The apparatus according to Claim 5, wherein the following conditional equation (2) is satisfied:

$$(2) \ 0.25 < R_s/D_a < 0.45,$$

where R_s is the radius of curvature of the lens surface nearest to the image side of the meniscus lens in the second lens group and D_a is the distance from the lens surface R_s in the wide angle end state to the aperture diaphragm.

7. The apparatus according to Claim 5, wherein the following conditional equation (3) is satisfied:

$$(3) \quad 0.7 < (R_1 - R_2) / (R_1 + R_2) < 0.9,$$

where R_1 is the radius of curvature of the lens surface nearest to the object side of the negative meniscus lens arranged in the second lens group and R_2 is the radius of curvature of the lens surface adjacent to the image side of glass lenses constituting the negative meniscus lens arranged in the second lens group.

8. The apparatus according to Claim 5, wherein the following conditional equation (4) is satisfied:

$$(4) \quad 0.3 < |f_2| / (f_w \cdot f_t)^{1/2} < 0.4,$$

where f_2 is the focal length of the second lens group; f_w is the focal length of the entire lens system in the wide angle end state; and f_t is the focal length of the entire lens system in the telescopic end state.